ROTOR BLADE AND ROTOR FOR A MECHANICAL TROWEL, SUCH AS A CONCRETE POLISHER

[0001] The present invention relates to a rotor blade for a mechanical trowel, such as a concrete polisher, comprising a blade arm, a blade plate, and a spacer bar disposed between the blade arm and the blade plate, this blade plate being removably fastened to the blade arm by means of the spacer bar.

[0002] The blade plate is an expendable part and should be replaced frequently. With a new set of blade plates, a concrete surface of about 1,000 m^2 can be polished. A worker has to work about 4 hours to polish this 1,000 m^2 surface, which means that the blade plates should be replaced twice a day. In the prior art, a spacer bar is attached to the blade plate by rivets. The blade plate that carries this spacer bar is attached to the blade arm by screws inserted into the blade arm on the opposite side from the blade plate and the spacer bar, and these screws are inserted into threaded holes in the spacer bar. The rivet holes to be bored into the spacer bar must be counter-bored on both sides so that the heads of the rivets can be sunk, on one side, into the spacer bar, and on the other side into the spacer bar and into a chamfered hole in the blade plate. Producing the blade plate with its spacer bar is therefore expensive, and it has to be thrown away with the blade plate when the blade plate is worn out and must be replaced, even if the spacer bar is not worn or damaged. This spacer bar is necessary in order to position the blade plates at a level lower than the hub of the rotor supporting the rotor blades so that the rotor hub cannot come in contact with the concrete surface to be polished.

[0003] The object of the present invention is to eliminate the aforementioned disadvantages, i.e., to simplify the production of the rotor blade and reduce the cost of replacing the blade plates.

[0004] According to a first subject of the present invention, a rotor blade is provided for a mechanical trowel such as a concrete polisher, comprising:

a. a blade arm
b. a blade plate, and
c. a spacer bar disposed between the two,

the blade plate and the spacer bar being removably fastened to the blade arm by threaded fastening means, characterized in that the spacer bar is not integral with the blade plate, and the threaded fastening means run through unthreaded through-holes formed in at least the blade plate and the spacer bar so that the blade plate is separated from the spacer bar when the fastening means are removed.

[0005] The rotor blade according to this subject of the present invention can be produced at a reduced cost because it is no longer necessary to attach the spacer bar to the blade plate with a riveted connection, and because there is no longer any need for threaded holes in the spacer bar in order to attach the blade plate/spacer bar assembly to the blade arm. Moreover, since the spacer bar is no longer integral with the blade plate, only the blade plate need be replaced when it is worn.

[0006] In one embodiment of this first subject of the present invention, the threaded fastening means can be bolts inserted into threaded holes in the blade arm, but preferably, these threaded fastening means are bolts with nuts, which also run through unthreaded through-holes formed in the blade arm. In this case, there is no need for threaded holes in the spacer bar or in the blade arm, and a new plate, with a spacer bar that is not integral with the plate, can be attached to an existing mechanical trowel without modifying or replacing the blade arm. Also, replacing the worn blade plate is easier because there is no longer any need to look for the threaded holes in the spacer bar, which are covered by the blade arm when the new blade plate with its spacer bar is held in place against one side of the blade arm while the threaded bolts are inserted from the other side of the blade arm.

[0007] Preferably, the holes formed in the blade plate and the spacer bar are chamfered on one side so that the heads of the bolts can be sunk into these chamfered holes. Furthermore, each bolt can be provided with a non-circular, for example square, section beneath its head, which is received in a countersunk part of the through-hole formed in the spacer bar in order to prevent the bolt from rotating when the nut is tightened. In order to prevent the threaded ends of the bolts from getting dirty, the nuts are preferably cap nuts that cover the threaded ends of the bolts.

[0008] According to a second subject of the present invention, the invention provides a rotor blade for a mechanical trowel, such as a concrete polisher, comprising:

a. a blade arm

b. a blade plate, and

c. a spacer bar disposed between the two, the blade plate being removably fastened to the blade arm by threaded fastening means,

characterized in that the spacer bar is not integral with the blade plate, but is integral with the blade arm, so as to form a subassembly comprising the blade arm and the spacer bar, and in that the threaded fastening means run through unthreaded through-holes formed in at least the blade plate so that the blade plate is separated from said subassembly when the fastening means are removed.

[0009] This second subject of the present invention makes it possible to further simplify the replacement of a worn blade plate because, after the blade plate is detached from the blade arm, the spacer bar remains attached to the blade arm. Of course, it is necessary to fasten, for example by welding or screwing, the spacer bar to the blade arm in the case of the second subject of the present invention. As in the case of the first subject of the present invention, the threaded fastening means can be bolts inserted into threaded holes in the blade arm/spacer bar subassembly, or threaded fastening bolts with nuts running through unthreaded through-holes formed in the blade arm, the spacer bar, and the blade plate. The holes formed in the blade plate and the blade arm/spacer bar subassembly are preferably chamfered, and the bolts have heads that are sunk into these chamfered holes. If bolts with nuts are used, the bolts are preferably inserted, without being rotated, into the holes formed in the blade arm/spacer bar subassembly, and the bolts can be cap bolts.

[0010] In order to further reduce the costs of producing the blade, the present invention also provides, according to a third subject of the invention, a rotor for a mechanical trowel, such as a concrete polisher, comprising:

- a rotor hub having at least one rotor blade comprising:

a. a blade arm attached to the hub, and

b. a blade plate located at a level lower than the hub of the rotor and removably attached by threaded fastening means to a plate-bearing part of the blade arm,

characterized in that the plate-bearing part of the blade arm extends vertically to a level lower than the hub of the rotor, and the threaded fastening means run through unthreaded through-holes formed in at least the blade plate.

[0011] According to this third, alternative subject of the invention, the spacer bar is completely eliminated through the use of a plate-bearing part that extends vertically to a level lower than the hub of the rotor, which means that the plate-bearing part is extended vertically toward the bottom in order to position the blade plates at a level lower than the hub of the rotor.

[0012] According to one advantageous embodiment of this third subject of the invention, the plate-bearing part of the blade arm generally has a polygonal, for example hexagonal or rectangular, shape in cross section, this polygonal shape having a longitudinal central axis that is offset from the longitudinal central axis of a cylindrical root section of the blade arm fitted into the hub of the rotor, but the plate-bearing part of the blade arm can also have, in cross section, an upper hexagonal part and a lower part in the shape of a quadrilateral.

[0013] As in the first and second subjects of the invention, the blade plate can be fastened to the plate-bearing part of the blade arm by bolts screwed into threaded holes formed in the plate-bearing part of the blade arm, or preferably, by bolts with nuts running through unthreaded through-holes formed in the blade plate and in the plate-bearing part of the blade arm. The heads of the bolts are preferably sunk into chamfered parts of the holes formed in the blade plate and in the plate-bearing part of the blade arm. In the embodiment that uses through-bolts with nuts, the bolts are preferably inserted without being rotated into the holes formed in the plate-bearing part of the blade arm, and the nuts can be cap nuts.

[0014] The invention will now be explained in greater detail in reference to the attached drawings, in which:

[0015] Fig. 1 is a side view of a rotor of a mechanical trowel, such as a concrete polisher, with four blades, only one of which is represented, partly in cross section, fitted into the hub of the rotor.

[0016] Fig. 1A is a cross-sectional view along line 1A-1A in Fig. 1,

[0017] Figs. 2A and 2B represent the spacer bar in a top view and a side view, partially in cross section.

[0018] Fig. 3 is a perspective view of a rotor of a concrete polisher, according to another subject of the invention.

[0019] Figs. 4 and 5 show two different forms of the blade arm for a rotor in the subject of the invention according to Fig. 3.

[0020] Referring to Figs. 1, 1A, 2A and 2B, rotor 10 of a mechanical trowel, such as a concrete polisher according to the invention, includes a central hub 12 in the shape of a star wheel, with four arms 14 extending horizontally. Hub 12 is attached to vertical shaft 16 so as to rotate in a horizontal plane. Star wheel 12 has four blades 18. Another number of blades could be provided, for example, two, three, or more than four blades.

[0021] Each blade 18 includes blade arm 20, spacer piece 22, and blade plate 24. The blade arm has at its lower end root 26 in the shape of a circular shaft end seated in a radial bore in star wheel 12 so as to rotate around the longitudinal axis A of blade arm 20 in order to vary the angle of inclination of blade plates 24. A means (not represented) is provided for holding the blade in place, with root 26 inserted into the bore of star wheel 12, against the effect of the centrifugal force. In order to vary the angle of inclination, a lever for changing angle of inclination 28 is mounted on blade arm 20. An annular plate (not represented) surrounding shaft 16 engages levers 28 of all blades 18, and this plate is moved vertically along shaft 16 in order to change the angle of inclination of blades 18. Arms 20 of blades 18 have along most of their length a plate-bearing shape that is polygonal, preferably hexagonal, in cross section, perpendicular to the longitudinal axis A. Blade plate 24 is fastened to blade arm 20 by two bolts 30, which run through aligned, unthreaded through-holes 32, 34 and 36 formed in blade plate 24, blade arm 20, and intermediate spacer bar 22 disposed between blade plate 24 and blade arm 20. Spacer bar 22 is provided in order to separate plate 24 vertically by enough distance from blade arm 20 so that plate 24 is at a level lower than star wheel 12, so this star wheel does not come into contact with the concrete surface to be polished during the rotation of rotor 10.

[0022] Fastening bolts 30 have conical heads 38, which are partially sunk into chamfered holes 32 of plate 24, as well as into chamfered parts 34a provided at the lower

ends of holes 34 formed in spacer bar 22, because plate 24 is not thick enough to accommodate the entire conical head 38 of bolt 30. Between conical head 38 of bolt 30 and its threaded shaft 40 is a square part 42, which is received in countersunk part 34b of hole 34 of spacer bar 22 in order to prevent the rotation of bolt 30 when nut 44 is screwed and tightened onto the threaded end of bolt 30. This nut 44 is preferably a cap nut in order to prevent the threaded ends of bolt 30 from becoming dirty so that nut 44 can be unscrewed without any problem in order to replace plates 24.

[0023] Spacer bar 22 is therefore not integral with plate 24, and when bolts 30 are removed, plate 24 is separated from spacer bar 22 and only the worn plate 24, and bolts 30, if they are worn, but not spacer bar 22, will be replaced by a new plate 24. A riveted connection between plate 24 and spacer bar 22 is no longer necessary, and there is no need to produce threaded holes in spacer bar 22 because the bolts pass freely through aligned holes 32, 24 and 36 formed in plate 24, spacer bar 22, and blade shaft 20. For long blades, more than two bolts can be distributed along their length.

[0024] According to the second subject of the invention, spacer bar 22 can be attached by being welded, for example spot welded, or screwed, to blade arm 18, which further simplifies the replacement of worn plate 24.

[0025] Figs 2A and 2B show, in a bottom and side elevation, and partially in cross section, spacer bar 22. A through-hole 34 for a bolt 30 is represented at the left end of spacer bar 22. In Figs. 2A and 2B, we see chamfered part 34a of this hole 34 that receives part of head 38 of bolt 30, as well as the countersunk elongated part 34b that receives the square part 40 of bolt 38 in order to prevent the bolt from rotating inside hole 34. The through-hole for the bolt on the other side of spacer bar 22 is produced in the same way.

[0026] Plate 24 is made of spring steel, and holes 32 are bored and chamfered into plate 24. However, the holes can also be produced by pressing and stamping. The plate can also be made from a plastic, synthetic, or other appropriate material.

[0027] Referring now to Fig. 3, which shows part of a rotor 10' of a concrete polisher, according to the third subject of the invention. In this case, too, rotor 10' comprises star wheel 12', which corresponds to star wheel 12 in Fig. 1. Rotor blades 18' are distinguished from rotor blades 18 in Fig. 1 in that the spacer bar is eliminated and plate 24'

is attached directly to the lower surface of arm 20' of rotor blade 18'. Arm 20' of rotor blade 18' is also provided with a cylindrical root section 26', and lever arms for changing the inclination 28' are attached to arms 20'.

[0028] Arms 20' have along their main part, outside cylindrical root part 26', an elongated plate-bearing part 23' that forms most of the length of blade arm 20'. According to Fig. 3, this plate-bearing part 23' has a rectangular shape in cross section perpendicular to the longitudinal axis A of arm 20' of blade 18'. The long dimension of this rectangular shape is oriented vertically, and the horizontal bottom surface of plate-bearing part 23' is at a level lower than the bottom end of hub 12' so that plate 24' can be attached by bolts 30' directly to plate-bearing part 23' without any need for the spacer bar of Figs. 1 and 2. The longitudinal central axis A1 of this rectangular plate-bearing part is separated by a distance X from the longitudinal central axis A of cylindrical root part 26' (Fig. 4). Instead of the rectangular shape, another polygonal, for example hexagonal, shape could be provided (Fig. 5), or the plate-bearing part can have, in cross section, a first top polygonal, for example hexagonal, shape, and a second bottom polygonal, for example quadrilateral, part. Even a circular or flattened elliptical shape is possible. It is understood that the cross-sectional shape of plate-bearing part 23' is not essential; it is merely necessary for the bottom surface of this part 23', against which plate 24' is pressed by bolts 30', to be at a level lower than the bottom end of rotor 12'. It is also understood that bolts 30' are the same as in the embodiment of Figs. 1 and 2, but the vertical holes 34' formed in plate-bearing part 23' are now chamfered at the bottom in order to receive heads 38' of bolts 30', and holes 34' are also provided with a countersunk elongated part 34' for receiving the parts of the square section of bolts 30', thereby preventing bolts 30' from rotating in the holes formed in plate 24' and plate-bearing part 23'. In this embodiment, too, there is no need for a riveted connection, and only plate 24 has to be replaced when it is worn, possibly along with bolts 30', but the replacement of the spacer bar, as in the prior art, is not necessary, and in fact the spacer bar is eliminated entirely and replaced by a modified form of plate-bearing part 23' of arms 20' of rotor blades 18'.